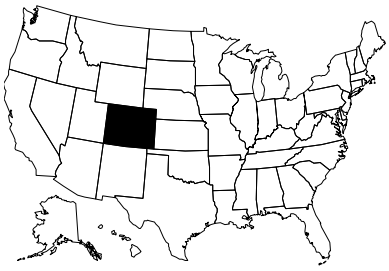
# COLORADO



## Contact Information

Robert McConnell, Monitoring Unit Manager
Colorado Department of Public Health and Environment (CDPHE)
4300 Cherry Creek Drive South ■ Denver, CO 80246
Phone 303/692-3578 ■ Fax 303/782-0390
email: robert.mcconnell@state.co.us
*CDPHE Water Quality Control Division* website: http://www.cdphe.state.co.us/wq/wqhom.asp

## Program Description

The Monitoring Unit of the Water Quality Control Division, Colorado Department of Public Health and Environment (CDPHE), is responsible for designing studies and collecting chemical, physical, and biological data from a statewide network of sampling stations. Personnel from the Assessment Unit of the Water Quality Control Division evaluate this information, along with data from other agencies. Using a watershed-specific approach, the seven major watersheds within the State of Colorado are assessed sequentially as part of the triennial review of water quality standards and classifications. In addition, specific waterbodies are assessed as part of targeted synoptic studies, site-specific studies, and as required for evaluating waterbodies listed on the State of Colorado's 303(d) list.

Most biological assessments are performed to evaluate aquatic life use classifications and to support standards development. Biological assessments have occasionally been used to determine attainment of aquatic life uses or attainment of provisional sediment standards. However, chemical information from surface water samples is primarily used to assess use support determinations as reported in the State of Colorado's biennial Status of Water Quality report. Biologists in the Monitoring Unit are actively developing biocriteria to more effectively utilize biological information as part of the State of Colorado's water quality standards program. Initially, biocriteria will be developed for benthic macroinvertebrates. Over the last four years, biologists in the Monitoring Unit have collected benthic macroinvertebrate samples from approximately 300 potential reference/least impaired sites from all dominant ecoregions within the State of Colorado. This data is currently being evaluated. Combined with information on physical habitat and water chemistry, this benthic macroinvertebrate data will be used to develop provisional region-specific biocriteria. Once developed, these provisional biocriteria will be evaluated using new benthic macroinvertebrate information, and further refined as needed. It is anticipated that benthic macroinvertebrate biocriteria will be used as an assessment tool to support the water quality standards and classification programs within the State of Colorado. Biocriteria based on fishery information may be developed in the future.

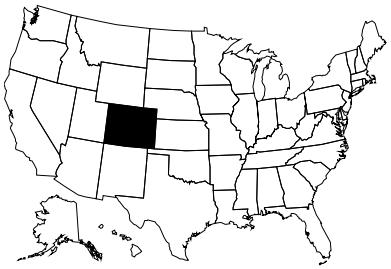
## Documentation and Further Information

Colorado's 2002 305(b) report and 1998 303(d) list: http://www.cdphe.state.co.us/op/wqcc/wqresdoc.html

*Draft 2001 Unified Assessment Methodology*, *Guidance on Data Requirements and Data Interpretation Methods Used in Stream Standards and Classification Proceedings*, July 1993:
http://www.cdphe.state.co.us/wq/Assessment/assessment_practices_and_methods.htm

*Water Quality in Colorado 2000*: http://www.cdphe.state.co.us/wq/waterqualitybooklet.pdf

# COLORADO



## Contact Information

Robert McConnell, Monitoring Unit Manager
Colorado Department of Public Health and Environment (CDPHE)
4300 Cherry Creek Drive South ■ Denver, CO 80246
Phone 303/692-3578 ■ Fax 303/782-0390
email: robert.mcconnell@state.co.us

## Programmatic Elements

| | | |
|---|---|---|
| **Uses of bioassessment within overall water quality program** | ✓ | problem identification (screening) |
| | ✓ | nonpoint source assessments |
| | ✓ | monitoring the effectiveness of BMPs |
| | ✓ | ALU determinations/ambient monitoring |
| | UD | promulgated into state water quality standards as biocriteria |
| | | support of antidegradation |
| | ✓ | evaluation of discharge permit conditions |
| | ✓ | TMDL assessment and monitoring |
| | ✓ | other: determine attainment of narrative sediment (clean) standard |
| **Applicable monitoring designs** | ✓ | targeted (i.e., sites selected for specific purpose) *(comprehensive use throughout jurisdiction, specific river basins or watersheds, and special projects)* |
| | ✓ | fixed station (i.e., water quality monitoring stations) *(specific river basins or watersheds)* |
| | | probabilistic by stream order/catchment area |
| | | probabilistic by ecoregion, or statewide |
| | ✓ | rotating basin *(comprehensive use throughout jurisdiction)* |
| | | other: |

## Stream Miles

| | |
|---|---|
| **Total miles** *(determined using RF3)* | **107,403** |
| Total perennial miles | 31,415 |
| **Total miles assessed for biology*** | **n/a** |
| fully supporting for 305(b) | n/a |
| partially/non-supporting for 305(b) | n/a |
| listed for 303(d) | 85.1 |
| number of sites sampled *(on an annual basis)* | ~70 -100 |
| number of miles assessed per site | – |

*Colorado does not use bioassessment in 305(b) assessments with some exceptions. Since Colorado's water quality standards are chemically oriented, the majority of use support determinations are based on chemical data. Bioassessments are conducted as part of the Triennial Standards Review process for Colorado's seven major watersheds; a few are used in the determination of aquatic life use and sediment standards attainment. The majority of CDPHE's work in the field is spent conducting bioassessments in preparation for the review process. During the review process, the Water Quality Control Commission uses biological data to determine the appropriate aquatic life use classification for 636 stream segments. Once classifications are set, all further water quality monitoring and assessment is chemical.

## Aquatic Life Use (ALU) Designations and Decision-Making

| | | |
|---|---|---|
| **ALU designation basis** | Class System, Warm Water vs. Cold Water | |
| **ALU designations in state water quality standards** | Three classifications: Class 1 Cold Water Aquatic Life, Class 1 Warm Water Aquatic Life, Class 2 Cold and Warm Water Aquatic Life | |
| **Narrative Biocriteria in WQS** | under development* | |
| **Numeric Biocriteria in WQS** | none* | |
| **Uses of bioassessment data in integrated assessments with other environmental data** (e.g., toxicity testing and chemical specific criteria) | ✓ | assessment of aquatic resources |
| | ✓ | cause and effect determinations |
| | ✓ | permitted discharges |
| | | monitoring (e.g., improvements after mitigation) |
| | | watershed based management |
| **Uses of bioassessment/ biocriteria uses in making management decisions regarding restoration of aquatic resources to a designated ALU** | Bioassessment endpoints are used as targets in the attainment of the sediment standard (e.g. TMDL development). | |

*ALU classifications are defined in Colorado's water quality standards but are not considered to be formal narrative biocriteria in the CO regulatory process. Colorado is presently developing biocriteria through a stakeholder workgroup process.

## Reference Site/Condition Development**

| | | |
|---|---|---|
| **Number of reference sites** | **300 total potential reference/least impaired sites** | |
| **Reference site determinations** | ✓ | site-specific |
| | | paired watersheds |
| | | regional (aggregate of sites) |
| | ✓ | professional judgment |
| | | other: |
| **Reference site criteria** | The condition of candidate sites is verified through field evaluation using a "checklist" of stream attributes that include, but are not limited to, measures of riparian condition, Rosgen channel type, land use, basin characteristics, physical habitat, substrate, chemistry, geology, vegetation, and climate. | |
| **Characterization of reference sites within a regional context** | ✓ | historical conditions |
| | ✓ | least disturbed sites |
| | | gradient response |
| | ✓ | professional judgment |
| | ✓ | other: minimally disturbed*** |
| **Stream stratification within regional reference conditions** | UD | ecoregions (or some aggregate) |
| | | elevation |
| | ✓ | stream type |
| | | multivariate grouping |
| | | jurisdictional (i.e., statewide) |
| | | other: |
| **Additional information** | n/a | reference sites linked to ALU |
| | n/a | reference sites/condition referenced in water quality standards |
| | n/a | some reference sites represent acceptable human-induced conditions |

**Reference condition is used on a limited basis in Colorado. Currently, it is used as a key component in determining sediment deposition impacts to aquatic life and has been used in the first stages of biocriteria development, to locate sampling sites, as part of various EMAP studies underway in CO, and in the development of regional nutrient criteria. The reference condition approach is not developed enough to be an established part of biological assessments or the standards setting process in Colorado. Most, if not all, assessments are conducted on a case-by-case or site-specific basis, and although CO does attempt to characterize the "expected condition" for a particular waterbody, it is not treated as a formal reference condition.

***Sediment guidance suggests 3 tiers for reference conditions like those described in the 1996 EPA technical guidance for biological criteria: 1) minimally disturbed, 2) best available (least disturbed), and 3) none acceptable ("hypothetical explanation"). These can be considered individually and in combination.

## Field and Lab Methods*

| | | |
|---|---|---|
| **Assemblages assessed** | ✓ | benthos *(100 - 500 samples/year; single season, multiple sites - watershed level)* |
| | ✓ | fish *(<100 samples/year; single season, multiple sites - not at watershed level)* |
| | UD | periphyton *(<100 samples/year; single season, multiple sites - watershed level)* |
| | | other: |
| **Benthos** | | |
| sampling gear | Surber, dipnet; 500 - 600 micron mesh | |
| habitat selection | riffle/run (cobble) or most productive habitat if riffle/run is not available | |
| subsample size | 300 count | |
| taxonomy | lowest possible level with positive identification | |
| **Fish** | | |
| sampling gear | backpack electrofisher | |
| habitat selection | multihabitat | |
| sample processing | length measurement | |
| subsample | none | |
| taxonomy | species | |
| **Periphyton** | | |
| sampling gear | **natural substrate**: brushing/scraping device (razor, toothbrush, etc), collect by hand | |
| habitat selection | riffle/run (cobble) | |
| sample processing | chlorophyll *a*/ phaeophytin, taxonomic identification | |
| taxonomy | all algae, species level | |
| **Habitat assessments** | visual based, hydrogeomorphology, pebble counts; performed with bioassessments | |
| **Quality assurance program elements** | standard operating procedures, periodic meetings and training for biologists, specimen archival | |

*Field and lab methods reported are those used by the Monitoring Unit of the CDPHE Water Quality Control Division and are patterned after the EPA RBP approach. They do not apply to any of the other agencies collecting biological data in Colorado.

## Data Analysis and Interpretation

| | | |
|---|---|---|
| **Data analysis tools and methods** | ✓ | summary tables, illustrative graphs |
| | | parametric ANOVAs |
| | | multivariate analysis |
| | ✓ | biological metrics *(return single metrics)* |
| | | disturbance gradients |
| | | other: |
| **Multimetric thresholds** | | |
| transforming metrics into unitless scores | impairment thresholds determined on case-by-case basis as part of site-specific analyses | |
| defining impairment in a multimetric index | Colorado is currently exploring possible metrics and indices through a workgroup process. | |
| **Evaluation of performance characteristics** | | repeat sampling |
| | ✓ | precision *(replicate samples collected at 10% of sites)* |
| | | sensitivity |
| | | bias |
| | | accuracy |
| **Biological data** | | |
| Storage | Currently moving all biological and habitat data into EDAS | |
| Retrieval and analysis | EDAS, Excel, Minitab | |